7-4 Remainder and Factor Theorems

Solve.
$x^3 + 4x^2 - 15x - 18 = 0$
If x - 3 is a factor.

3 | 1 4 -15 -18
3 21 18
1 7 6 | 0

$x^2 + 7x + 6$
$(x+6)(x+1) = 0$
$x = 3 \quad x = -6 \quad x = -1$

Solve.
$x^3 + 7x^2 + 2x - 40 = 0$
If x - 2 is a factor.

Solve.
$x^3 - 2x^2 + 9x - 18 = 0$
If x - 2 is a factor.

2 | 1 -2 9 -18
2 0 18
1 0 9 | 0

$x^2 + 9 = 0$
$x^2 = -9$
$x = \pm 3i$
$\{2, \pm 3i\}$

When it is a factor, what can you say about the remainder?

$= 0$

Is it a factor?

$f(-2) = -8 + 4 - 6 + 3$

$= -7$

$f(x) = x^3 + x^2 + 3x + 3$

Is $x + 2$ a factor?

$-2 \mid 1 \quad 1 \quad 3 \quad 3$

$\quad\quad -2 \quad 2 \quad -10$

$1 \quad -1 \quad 5 \mid -7$

No

$f(x) = x^3 + x^2 + 3x + 3$

Find $f(-2)$.

$f(x) = x^3 + x^2 + 3x + 3$

Is $x + 3$ a factor?

$-3 \mid 1 \quad 1 \quad 3 \quad 3$

$\quad\quad -3 \quad 6 \quad -27$

$1 \quad -2 \quad 9 \mid -24$

No $f(-3) = -24$

$f(x) = x^3 + x^2 + 3x + 3$
Is $x + 1$ a factor?

Find k such that
$2x^4 + x^3 + 5x^2 - 6x + k \div x + 2$ has a remainder of 5.

$-2 \mid 2 \quad 1 \quad 5 \quad -6 \quad k$
$\quad\quad -4 \quad 6 \quad -22 \quad 56$
$\quad 2 \quad -3 \quad 11 \quad -28 \mid 56+k$

$56 + k = 5$
$k = -51$

What is k so $x+2$ is a factor?
$56 + k = 0$
$k = -56$

$2x^4 + x^3 + 5x^2 - 6x + k$
Find k such that $x + 2$ is a factor.

Remainder Theorem (summary)
The remainder of $f(x) \div (x - a)$ is $f(a)$.

Factor Theorem (summary)
The binomial $(x - a)$ is a factor of $f(x)$ iff $f(a) = 0$.

"if and only if"

$f(x) = 3x^4 - 2x^3 + x^2 - 2$

$f(4) =$

$f(2) =$

HW
p368-369
13-17, 21-27, 31-35 all odds